

## BACKGROUND

Software support is needed to create a stereoscopic vision sensor which provides real-time 3D data for a wearable assistive device. This sensor will be used to generate a video depth map, determine relative velocity, and possibly perform object detection of surroundings at typical video framerates. This data will be used to provide acoustic feedback for visually impaired users.

A large body of knowledge currently exists for stereo video systems like this, although several unique algorithms are needed to achieve the desired functionality. This system will be focused on providing position and velocity vectors in real time, both of which achieved using disparity mapping (stereo and temporal respectively). Because of this the deliverable will be referred to as a Real-Time Disparity Mapping (RTDM) sensor.

## PROJECT SCOPE

1. Create working RTDM system using team specified hardware. This system will output an array of position and velocity vectors for each eligible element extracted from the visual field.
  - a. The array will be in a format defined by the associated acoustic feedback device, called SNAP. The interface for this device is currently being developed by the Sightless Navigation Assistance senior design team.
  - b. Data may be handed off by writing to a buffer from which SNAP will read directly on shared hardware.
  - c. Visual output of sensor data is desired.
2. Customize feature extraction algorithms to allow for specified feature and motion driven variation in point density.
  - a. Refine feature extraction to provide increasing density of points around objects moving toward the user as a function of velocity and direction.
  - b. Incorporate edge detection and plane filtering to reduce sampling on large planar objects.
3. Expand upon RTDM output with more features information (time permitting).
  - a. Include additional variables such as element/pixel color and brightness.
  - b. Calculate and output acceleration of elements.
  - c. Determine position, velocity and acceleration of user.

## SPECIFICATIONS

Property	Min	Nom	Max	Units
Working elements*		2048 (min)		-
Angle between adjacent elements (default)**	1.5	3.0	4.5	degrees
Angle between adjacent elements (velocity refinement)**		1.5		degrees
Framerate	15	30	60	FPS
Depth of field (max)	15	20	30	m

\* Elements extracted which are successfully incorporated in the disparity map

\*\*This angle is measured between adjacent position vectors, with the origin at the users point of view